Issued July 10, 1911.

U. S. DEPARTMENT OF AGRICULTURE.

FARMERS' BULLETIN 457.

Experiment Station Work, LXIV.

Compiled from the Publications of the Agricultural Experiment Stations.

MAY, 1911.

PREPARED IN THE OFFICE OF EXPERIMENT STATIONS.
A. C. TRUE, Director.

WASHINGTON:
GOVERNMENT PRINTING OFFICE.
1911.

THE AGRICULTURAL EXPERIMENT STATIONS.

ALABAMA—
College Station: *Auburn;* J. F. Duggar.[1]
Canebrake Station: *Uniontown;* F. D. Stevens.[1]
Tuskegee Station: *Tuskegee Institute;* G. W. Carver.[1]

ALASKA—*Sitka:* C. C. Georgeson.[2]

ARIZONA—*Tucson:* R. H. Forbes.[1]

ARKANSAS—*Fayetteville:* C. F. Adams.[1]

CALIFORNIA—*Berkeley:* E. J. Wickson.[1]

COLORADO—*Fort Collins:* C. P. Gillette.[1]

CONNECTICUT—
State Station: *New Haven;* E. H. Jenkins.[1]
Storrs Station: *Storrs;* L. A. Clinton.[1]

DELAWARE—*Newark;* H. Hayward.[1]

FLORIDA—*Gainesville:* P. H. Rolfs.[1]

GEORGIA—*Experiment:* Martin V. Calvin.[1]

GUAM—*Island of Guam:* J. B. Thompson.[2]

HAWAII—
Federal Station: *Honolulu;* F. V. Wilcox.[2]
Sugar Planters' Station: *Honolulu;* C. F. Eckart.[1]

IDAHO—*Moscow:* W. L. Carlyle.[1]

ILLINOIS—*Urbana:* E. Davenport.[1]

INDIANA—*La Fayette:* A. Goss.[1]

IOWA—*Ames:* C. F. Curtiss.[1]

KANSAS—*Manhattan:* E. H. Webster.[1]

KENTUCKY—*Lexington:* M. A. Scovell.[1]

LOUISIANA—
State Station: *Baton Rouge;*
Sugar Station: *Audubon Park, New Orleans;*
North La. Station: *Calhoun;*
Rice Station: *Crowley;*
} W. R. Dodson.[1]

MAINE—*Orono:* C. D. Woods.[1]

MARYLAND—*College Park;* H. J. Patterson.[1]

MASSACHUSETTS—*Amherst:* W. P. Brooks.

MICHIGAN—*East Lansing:* R. S. Shaw.[1]

MINNESOTA—*University Farm, St. Paul:* A. F. Woods.[1]

MISSISSIPPI—*Agricultural College:* J. W. Fox.[1]

MISSOURI—
College Station: *Columbia;* F. B. Mumford.[1]
Fruit Station: *Mountain Grove;* Paul Evans.[1]

MONTANA—*Bozeman:* F. B. Linfield.[1]

NEBRASKA—*Lincoln:* E. A. Burnett.[1]

NEVADA—*Reno:* J. E. Stubbs.[1]

NEW HAMPSHIRE—*Durham:* J. C. Kendall.[1]

NEW JERSEY—*New Brunswick:* J. G. Lipman.[2]

NEW MEXICO—*Agricultural College:* Luther Foster.[1]

NEW YORK—
State Station: *Geneva;* W. H. Jordan.[1]
Cornell Station: *Ithaca;* L. H. Bailey.[1]

NORTH CAROLINA—
College Station: *West Raleigh;* C. B. Williams.[1]
State Station: *Raleigh;* B. W. Kilgore.[1]

NORTH DAKOTA—*Agricultural College:* J. H. Worst.[1]

OHIO—*Wooster:* C. E. Thorne.[1]

OKLAHOMA—*Stillwater:* J. A. Wilson.[1]

OREGON—*Corvallis:* J. Withycombe.[1]

PENNSYLVANIA—
State College: T. F. Hunt.[1]
State College: Institute of Animal Nutrition, H. P. Armsby.[1]

PORTO RICO—
Federal Station: *Mayaguez;* D. W. May.[2]
Sugar Planters' Station: *Rio Piedras;* J. T. Crawley.[1]

RHODE ISLAND—*Kingston:* H. J. Wheeler.[1]

SOUTH CAROLINA—*Clemson College:* J. N. Harper.[1]

SOUTH DAKOTA—*Brookings:* J. W. Wilson.[1]

TENNESSEE—*Knoxville:* H. A. Morgan.[1]

TEXAS—*College Station:* H. H. Harrington.[1]

UTAH—*Logan:* E. D. Ball.[1]

VERMONT—*Burlington:* J. L. Hills.[1]

VIRGINIA—
Blacksburg: S. W. Fletcher.[1]
Norfolk: Truck Station, T. C. Johnson.[4]

WASHINGTON—*Pullman:* R. W. Thatcher.[1]

WEST VIRGINIA—*Morgantown:* J. H. Stewart.[1]

WISCONSIN—*Madison:* H. L. Russell.[1]

WYOMING—*Laramie:* H. G. Knight.[1]

[1] Director. [2] Special agent in charge. [4] Acting Director.

EXPERIMENT STATION WORK.

Edited by W. H. Beal and the Staff of Experiment Station Record.

Experiment Station Work is a subseries of brief popular bulletins compiled from the published reports of the agricultural experiment stations and kindred institutions in this and other countries. The chief object of these publications is to disseminate throughout the country information regarding experiments at the different experiment stations, and thus to acquaint farmers in a general way with the progress of agricultural investigation on its practical side. The results herein reported should for the most part be regarded as tentative and suggestive rather than conclusive. Further experiments may modify them, and experience alone can show how far they will be useful in actual practice. The work of the stations must not be depended upon to produce "rules for farming." How to apply the results of experiments to his own conditions will ever remain the problem of the individual farmer.—A. C. True, Director, Office of Experiment Stations.

CONTENTS OF NO. LXIV.

ILLUSTRATION.

EXPERIMENT STATION WORK.[1]

LOW-GRADE FERTILIZERS ARE EXPENSIVE.[2]

The old adage "never buy a thing simply because it is cheap; it will be dear to you in the end" applies with special force in the purchase of fertilizers. No one thing has been more clearly demonstrated by the work of the experiment stations than that it does not pay to buy low-priced, low-grade fertilizers. The low-grade fertilizers, though cheaper as measured by price per ton, are more expensive when measured by the actual amount and quality of plant food which they contain and by the cost of handling. B. E. Rose, from a comparison of the composition and cost of fertilizers on sale in Florida, shows that "the high-grade fertilizers for but little more than a third advance in price over the cost of the low-class goods furnish two-thirds more plant food and five-sixths more commercial value." Classifying the 127 brands of fertilizers examined by him during one year, Prof. Rose found the following results:

Relative composition, selling price, and valuation of low-grade, medium, and high-grade fertilizers.

Class.	Nitrogen.	Available phosphoric acid.	Potash.	Total plant food.	Average selling price.	Average station valuation.	Excess of selling price over valuation.
	Per cent.	*Per cent.*	*Per cent.*	*Lbs.*			
Low grade	1.13	8.28	2.50	11.9	$24.50	$16.85	$7.65
Medium grade	2.32	8.72	3.66	14.4	30.60	24.84	5.10
High grade	4.00	7.00	10.00	21.0	36.50	32.70	3.80

This table shows that with the low-grade fertilizers the selling price was 45 per cent greater than the valuation, with medium-grade fertilizers 20 per cent, and with high-grade fertilizers 11 per cent. The same facts are shown graphically in figure 1.

An examination of fertilizers sold in Vermont in 1910 showed that—

The medium-grade goods for one-ninth in advance in price over the cost of the low-grade brands offered one-fifth more plant food and two-fifths more commercial value.

[1] A progress record of experimental inquiries published without assumption of responsibility by the department for the correctness of the facts and conclusions reported by the stations.

[2] Compiled from Indiana Sta. Bul. 148; Massachusetts Sta. Bul. 135; Mississippi Sta. Bul. 142; Missouri Sta. Bul. 91; New Hampshire Sta. Circ. 12; New York State Sta. Bul. 230; Vermont Sta. Bul. 154; Univ. Rec. [Florida], 5 (1910), No. 3, p. 97; Maryland Agr. Col. Quart., 1911, No. 51.

The high-grade fertilizers for three-sevenths advance in price over the cost of the low-class goods furnished nearly three-fifths more plant food and almost double the commercial value. * * *

Some Vermont buyers paid 44½ cents for a pound of nitrogen which they might have bought for 26½ cents laid down at their doors in mixed fertilizers. They paid under similar circumstances 9½ cents a pound instead of 5½ cents for phosphoric acid and 9½ cents for potash instead of 5½ cents.

From an examination of fertilizers sold in Massachusetts in 1910 H. D. Haskins shows "that nitrogen cost 8.96 cents, available phosphoric acid about 2 cents, and potash 1.9 cents per pound more in the average low-grade fertilizer than in the average high-grade goods."

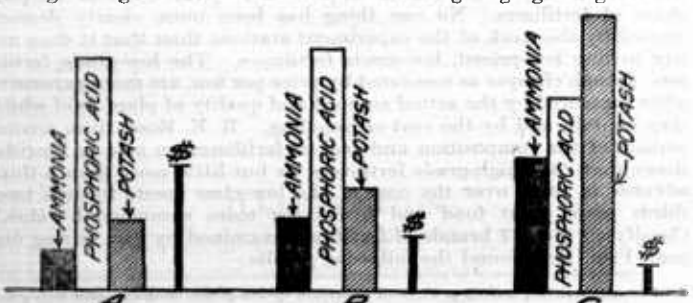

FIG. 1.—Diagram showing relative composition and cost of fertilizers: *A*, Low grade; *B*, medium grade; *C*, high grade.

Noting the fact that over half of the fertilizers were medium or low grade, Mr. Haskins says:

It is evident that too many purchasers select a fertilizer for its low cost and without much regard to the plant food which they are getting. The object in buying a fertilizer should be to get the largest amount of plant food in the proper form and proportion for the least money. The high-grade goods approach as near this ideal as is possible in case of factory mixed fertilizers. It costs just as much to freight, cart, and handle the low-grade fertilizers as it does the high grade. Nitrogen and potash in low-grade fertilizers cost from a third to a half more than if obtained from high-grade goods. The farmer can not afford to buy low-grade fertilizers.

A bulletin of the Missouri Station calls attention to the fact that there is a great demand in that State for cheap fertilizers which is supplied by a low-grade fertilizer containing about 0.82 per cent of nitrogen, 7 per cent of available phosphoric acid, and 1 per cent of potash, and selling for $19 per ton. The station valuation for this fertilizer is $12.88. It is shown that a fertilizer supplying the same amounts of plant food in form of high-grade materials could be prepared from 125 pounds of dried blood, 110 pounds of sodium nitrate

or 200 pounds of tankage, 1,000 pounds of 14 per cent acid phosphate or 875 pounds of 16 per cent acid phosphate, and 40 pounds of high-grade sulphate of potash. By using such a mixture handling and freight on from 760 to 975 pounds of useless "filler" for each ton of fertilizer would be saved. Moreover, this saving of freight and handling is not the only advantage of eliminating "filler," for in these cheap fertilizers garbage tankage and muck or peat "filler" are used to a considerable extent to supply the bulk and at the same time to furnish a considerable portion of the nitrogen, the most expensive ingredient of the fertilizer, and it is a well-known fact that the nitrogen in these materials is much less available than in high-grade materials.

Many farmers say they can not afford to spend more than $1.50 per acre for fertilizer on their corn or wheat, which means they are using about 150 pounds per acre of the low-grade fertilizer above mentioned. A fertilizer containing 2½ per cent nitrogen, 24 per cent phosphoric acid from bone, and 4 per cent potash can be bought for about $30 per ton. * * *

One ton of such a fertilizer costing $30 will contain over 250 pounds more of total plant food than 2 tons of low-grade fertilizer, costing $40 for the 2 tons. The 1 ton of high-grade fertilizer contains about $6 worth of plant food more than the 2 tons of cheap fertilizer, making a saving to the farmer of about $16, with only one-half as much to haul from the station. If he uses one-half as much per acre of the high-grade fertilizer, he is using more plant food with an actual saving of at least 60 cents per acre.

A bulletin of the Mississippi Station says:

The purchase of the so-called cheap or low-grade fertilizers is certainly never advisable. The cheapness of these mixtures is only apparent. It is not the price per ton of the fertilizer, but the price per pound of the plant food in it which should be subjected to inquiry by the merchant or farmer who is ready to buy.

A low-grade fertilizer can be sold by the retailer at a low price per ton, but no saving is effected when the price per pound of its valuable ingredients is considered.

The Indiana Station has repeatedly urged farmers to buy fertilizers on the basis of unit of available plant food desired and not on price per ton, and has pointed out "the folly of purchasing low-grade fertilizers at an increased cost per unit of plant food and paying freight on a large amount of filler which is without value."

H. B. McDonnell, of the Maryland Agricultural College, says, "avoid the 'cheap' low-grade fertilizers if you would avoid filler. * * * The cheapest filler is the soil in the field and the cheapest mixing machine is the harrow."

It thus appears plain that not only are low-grade fertilizers more expensive as regards first cost of plant food, but they are more costly to handle per unit of plant food supplied than the high-grade fertilizers on account of the larger amount of worthless filler which they contain. If low-grade fertilizers are to be used, it is much more economical to buy the unmixed materials, as suggested by the Missouri Station.

JAPANESE CANE FOR FORAGE.[1]

Natural grasses will supply forage for live stock in the South except for a short period during the winter months. Japanese cane will meet the need for good pasture from the middle of November to March. It is thus very important because it will supply a large amount of roughage at the season when natural pasturage is limited.

J. M. Scott, of the Florida Station, says that there were in that State 412,820 head of cattle January 1, 1900, and 807,000 January 1, 1910. He estimates that "if the number of cattle should increase as rapidly in the next 10 years as in the last 10 years, we shall own one million and a half head in 1920." A factor limiting such an increase is the ability of the State to supply sufficient forage to feed such a number of animals. If we stop to consider that on January 1, 1910, there were also 98,000 sheep and 456,000 hogs in Florida, we will realize the enormous quantities of forage required. "The needed extra supply of forage can easily be obtained by the growing of Japanese cane. There is no other crop that we can grow that will produce such a large yield of forage at so small a cost."

Japanese cane was introduced through the Louisiana Sugar Experiment Station for sugar and sirup production, but is of practical value mainly as a forage crop. It will yield from 150 to 500 gallons of sirup per acre, but is not grown for this purpose because of difficulty in stripping and grinding. It may be used as silage for winter pasture or stored as dry forage. It is best adapted to the climatic and soil conditions in Florida and the southern portions of Georgia, Alabama, Mississippi, Louisiana, and Texas, but will do well in any section in which the velvet bean will mature seed. This includes the territory within 200 to 250 miles of the northern coast of the Gulf of Mexico.

A variety of soils will grow Japanese cane reasonably well, but every farmer in Florida should grow a few acres whether he has the class of soil best suited to it or not. The same statement will apply to other regions to which it is adapted. Although good hammock land will doubtless produce the heaviest yields, high pine lands properly fertilized will give good returns. On swampy muck a good growth may be expected, but the yield will be greatly increased by an application of ground limestone or burnt lime. The amount which should be added will range from 2,000 to 6,000 pounds of ground limestone or from 1,000 to 3,000 pounds of air-slaked lime per acre. The proper amount of lime to apply will vary with the amount of acid in the soil. An application of 2,000 pounds of ground limestone per acre to high pine land on the Florida Station farm apparently increased the yield more than 10 tons in 1909.

[1] Compiled from Florida Sta. Bul. 105.

When pastured by cattle little of the cane is wasted. The animals first consume the blades and upper tender joints, then eat from the upper portion of the stalk until only the stubble remains. Pasturing after March 1 by any animals is likely to injure the stand, as the new growth is cropped and the plants may be killed.

Silage made from Japanese cane is relished by cattle and has proved about one-third lower in cost than sorghum or corn silage. It has proved a satisfactory feed for the dairy herd at the Florida Experiment Station and is recommended as "one of the cheapest and most economical crops that the Florida farmer can grow for silage." The cost of cane silage should not exceed $1.75 or $2 per ton.

For dry-forage purposes the crop is easily cured and the storage loss is small. After six months' storage at the experiment station there was practically no loss, and the cane, when run through a feed cutter, was relished by cattle, horses, and mules. If there is no room for storage in the barn it will be profitable to build a temporary inexpensive shed to keep off the rain. The butts of the canes should be placed on the ground in order that they may absorb moisture from the soil. This will prevent them from becoming as dry as they otherwise would.

As Japanese cane is a perennial, it will continue to furnish forage for many years from one planting, if properly handled. It is planted by cutting the canes into pieces or by dividing the stools. The cuttings furnish the cheapest seed. The buds will stand but little frost without injury, so the seed canes should be cut and banked before there is danger from the first fall frost. When banked the canes must not only be covered sufficiently to protect them against frost, but must be furnished proper moisture conditions. If standing water should be present the canes rot, but if the beds become too dry a large amount of the seed will be lost through dry rot. It is a good plan to make several small beds rather than a single large one.

The work and expense of banking seed cane are often saved by planting in the fall immediately after the selection and harvesting of the seed. In the northern and western portions of the State there is danger that fall planting will result in an unsatisfactory stand. In these regions the expense of banking will be repaid by the assurance that only good cane will be planted in the spring. Fall planting between November 10 and 20 is confined to central and southern Florida; north of this region spring planting during the month of March will prove more satisfactory.

If the rows are 8 feet apart about 3,000 whole canes will be required to plant an acre. Only healthy and well-matured canes should be used, as it is nearly impossible to remedy a defective stand. New canes planted in missing hills make little or no growth, because the

extensive root systems of well-established canes crowd them out. It costs less to cultivate and keep down the weeds on an acre that will produce 20 tons of cane than on one that will yield but half that weight. The canes should be cut in pieces having 3 or 4 eyes each and dropped in a double line. Some farmers drop 12 to 18 inches apart in a single line. This reduces the amount required to plant an acre to 1,500 or 2,000 canes, but gives a thin stand and a small yield of forage.

The seed bed should be very carefully prepared, because the crop occupies the field a number of years without further seed-bed preparation. The ground should be plowed to a depth of 6 inches and all vegetable growth turned under. It should then be harrowed at once, and the harrowing repeated if necessary to reduce the surface to good tilth. The rows may be laid off with a marker made of 2 by 6 inch lumber if desired. The disk cultivator is the most satisfactory implement for opening the furrow, as well as for covering the canes. The disks should be set close together in throwing out rows and run quite deep. In covering, the disks should be set as far apart as possible in order to avoid catching the canes and throwing them out on the top of the bed. The surface should be left level rather than in ridges. The cost of planting is reduced by 20 to 40 per cent if the disk cultivator is used instead of other implements.

The large root system of this crop makes it a gross feeder requiring a liberal amount of fertilizer. On the experiment station farm good results have been obtained from the application of 2,000 pounds of ground limestone per acre and from 400 to 600 pounds of a mixture containing 3 per cent ammonia, 6 per cent phosphoric acid, and 7 per cent potash. The ammonia may be furnished by dried blood or sulphate of ammonia, and the source of the potash likewise makes no material difference. Because of the long growing season of the crop, half the fertilizer should be applied in the latter part of April and the remainder in the early part of August. This will prevent so much being lost by leaching during the rainy season and insure the plant some food during the latter part of the season. Since a new root system is formed every year, the fertilizer need not be applied early. The feeding roots do not start until the tops have made a considerable growth, and the plants use the stored-up plant food in the old stubs of the rattoons during the early period of growth.

The cultivation of Japanese cane is similar to that of corn and cotton. The seed bed should be even more carefully and deeply prepared, because the crop will probably occupy the same field for a number of years without further plowing. After the first year the ground should be thoroughly stirred 3 or 4 inches deep in the early spring. A disk harrow or a 2-horse cultivator driven between the

rows will do the work very well without injuring the roots, as the new growth has not yet been made. A second shallower cultivation should immediately follow the application of fertilizer, and each succeeding cultivation should be shallower than the preceding one to avoid root pruning.

Harvesting should not be done too early. The chief value of the crop lies in its high sugar content, and all saccharine forage crops must reach a certain stage of maturity in order to furnish feed of the best quality. Sugar formation does not go on during rapid plant growth, but only when the cool weather of fall has set in. Cane silage will keep better and have a higher feeding value if made from mature cane. Care should, of course, be taken to prevent injury by frosts, but if fed soon after a frost injury the loss will be slight. The canes are too heavy to be successfully cut with a mowing machine, and after two years' growth the rows spread too widely for successful work with the corn harvester. As yet the most satisfactory instruments for cutting are the machete corn knife and the hoe.

The rows of Japanese cane may be planted 8 feet apart and velvet beans planted 2 or 3 feet apart in the row between them. Both cane and beans should be given good cultivation until long runners prevent further work. The beans should be planted early in the season to prevent the cane from completely smothering them. As the cane is rich in carbohydrates, which include its sugar and fiber, it is well to mix it with high protein feeds. For this purpose velvet beans, cottonseed meal, soy beans, cowpeas, oil meal, alfalfa, or clover may be used if available. Because of the bulky nature of the Japanese cane, the more concentrated foods are especially valuable.

After conducting feeding experiments the Florida Station recommends these rations: (1) 12 pounds of Japanese cane, 10 pounds of velvet beans in the pod, and 2 pounds of cottonseed meal, and (2) 10 pounds each of Japanese cane and cowpea hay, and 8 or 10 pounds of velvet beans in the pod.

FIGHTING THE BOLL WEEVIL BY CLEAN FARMING METHODS.[1]

The Department of Agriculture has spent more than a million dollars in studying and fighting the boll weevil, and the cotton States have added to this sum until it greatly exceeds this figure.

Any effective method of combating the boll weevil must be based on accurate knowledge of its life history and habits. It will feed or breed only on the cotton plant. Clean farming methods attack the

[1] Compiled from Alabama College Sta. Bul. 146; Circs. 5, 6, and 7; Louisiana Crop Pest Com. Circs. 3, 15, 28, and 31. The life history of the boll weevil and methods of avoiding its ravages are fully dealt with in the following publications: Alabama College Sta. Bul. 129; Mississippi Sta. Bul. 139, Circ. 17; Texas Sta. Bul. 74, Circs. 4 and 8; U. S. Dept Agr., Farmers' Buls. 130, 163, 189, 200, 211, 216, 314, and 344; Bur. Ent. Bul. 51, and Circ. 122; Louisiana Crop Pest Com. Circs. 5, 8, 9, 16, 22, 23, 24, 25, 33.

weevil by removing its food, prolonging the period of starvation, and destroying the material in which it spends the winter. It has been found advisable to remove stalks and carefully screen in any seed houses which may be in or near cotton fields. Moss on forest trees may shelter vast numbers of weevils during the winter.

The most important step, however, is the destruction of the cotton plants by October 10, or as soon after that date as possible. It is readily seen that if its only food is removed from three to five weeks before the first killing frost causes it to go into winter quarters, the number of weevils present during the following spring and summer will be greatly reduced. This measure is especially important along the line of advance of the weevil in territory not yet infested. After making long flights late in the season, the presence of growing cotton gives the weevil a good opportunity to feed before going into winter quarters. If the plants have been destroyed early, however, the long flight, followed by starvation, greatly decreases the probability of the weevils appearing the following season in this new territory.

The Louisiana State Crop Pest Commission found that when cotton plants were destroyed before October 15, only 3 per cent of the weevils survive. The necessity for prompt and early destruction of the plants is indicated by the survival of 15 per cent of the weevils where plants remained until the period between October 15 and 27; when plants were destroyed between November 1 and 25 about 22 per cent of the weevils survived; and when the plants were destroyed between November 25 and December 7, 28 per cent of the weevils lived through the winter. Allowing the plants to stand until Christmas allowed 43 per cent of the weevils to survive and attack the next cotton crop. Starvation of the weevil before it entered winter quarters "was more effective in causing death than cold or wet weather during the winter." If the cotton plants are not removed the weevil is not deprived of food for more than about 94 days. If they are destroyed October 10, the average weevil must starve unless it can go 180 days without food. The average time that weevils remained in winter quarters was 159 days. The fact that one weevil lived 255 days, or 8½ months, without food indicates that even the possible 6 months' starvation does not entirely eradicate the weevil, but it prepares the way for much more effective use of other cultural methods and spraying. The length of time between coming out of winter quarters and the death of the weevil has an important application to the time of spraying or other use of poisons. The average weevil lived about 11 days, but in one case this period reached 44 days from winter quarters.

If rains occur after the maturity of the crop many small bolls may be formed. This condition favors the rapid increase of the weevils until frost destroys the cotton. These late-developed weevils are

most likely to survive the winter. They do not enter winter quarters exhausted by long flights, starvation, or the other activities of older weevils.

Cotton stalks may be destroyed or removed by (1) uprooting, piling, and burning; (2) by cutting with a stalk chopper, plowing under deeply, and disking the field after plowing; or (3) by turning in enough animals to consume all the green cotton in a few days. The first method is the most effective as the second allows some weevils to escape to the surface unless very thoroughly done. Grazing is possible only in exceptional cases. After the burning method "the cheapest, most effective and preferred plan is to use what is known as the V-shaped cotton-stalk cutter."[1] Stalks not completely severed in cutting should be pulled or chopped to prevent their remaining green and supplying food for weevils. The windrowed stalks may be piled with a pea-vine rake or otherwise and burned after a week or 10 days' drying, crude oil being used if necessary. They should be placed in position to burn while still green, so that the weevils may be concentrated under the rows or piles and destroyed by the fire. Stalks may be plowed out but this is less effective and requires more work.

In addition to destroying the cotton plants on which weevils feed, all kinds of rubbish along ditches, fences, terraces, turn rows and field borders should be destroyed to remove winter shelter.

Perhaps the most convincing proof of the wisdom of the early fall destruction of cotton plants is shown by the actual field results observed in two instances. On November 13, 1907, a severe frost completely destroyed the squares, green bolls, and foliage on the cotton plants in the northern parishes of Louisiana. The following spring the boll weevil was so rare that the newspapers reported that it had entirely disappeared. Farther south where the frost was less severe more weevils survived. A steady increase in the number of surviving weevils was noted from north to south.

During 1906 and 1907 the Bureau of Entomology of this Department conducted a field experiment in Calhoun County, Tex. Cotton plants on 400 acres were uprooted and burned during the first 10 days of October, 1906. No other cotton was grown within 30 miles. "Up to May 1, 1907, but 1 weevil was found in the 400-acre area at Olivia, while in the check fields, 30 miles away, where the stalks had not been destroyed the previous fall, the weevils were so numerous that practically every square was being destroyed by May 1." In August, 1907, there was an average of 10 bolls per plant left on the Calhoun County fields near Olivia, but only 3 bolls per plant remained where cotton had not been destroyed the previous fall. At Olivia an average of 615 pounds of seed cotton per acre was secured as

[1] For description see the succeeding number of this series of bulletins.

compared with 225 pounds in the fields 30 miles away, where the cotton was not destroyed the fall before. At 10 cents per pound for lint and $12 a ton for seed this difference in yield paid $14.56 per acre or about 29 times as much as it had cost to clear the fields of green cotton the fall before.

HASTENING MATURITY OF COTTON WITH FERTILIZERS.[1]

In order to successfully combat the boll weevil much attention has been given to the development of early ripening varieties of cotton. Recent experiments at the North Carolina Experiment Station, reported by C. B. Williams, show the important extent to which early ripening may be promoted by judicious use of fertilizers.

In a large number of tests on a wide variety of soils it was found that the use of fertilizers in all cases hastened maturity. About 50 per cent more cotton was open at the first two pickings on the fertilized plats than on those which had not been fertilized. The effect was, however, somewhat more marked on sandy and sandy loam soils than on red clay soils. The most marked effect was obtained from the use of heavy applications of phosphoric acid.

As carriers of phosphoric acid, acid phosphate, basic slag, and finely ground phosphate rock have been tested, and all have been found to hasten the maturity of cotton, as shown by the percentage of seed cotton open at first and second pickings. In fact, the hastening of the maturity was decidedly more marked from phosphatic fertilizing materials than from carriers of potash and nitrogen tried. Increasing the quantity of phosphoric acid derived from acid phosphate with normal amounts of potash and nitrogen was attended by a gradual increase in the percentage of total seed cotton open at the first picking.

Nitrogen was more effective than potash in hastening maturity. Air-slaked lime did not hasten maturity, but when used in connection with other fertilizing materials increased their effect in hastening maturity. It was observed that—

When 196 pounds of acid phosphate was added to an application consisting of a mixture of 48 pounds of manure salt and 78 pounds of dried blood, there was almost 13 per cent increase in seed cotton open of total crop at the first picking and more than 7 per cent increase at the end of the second picking. This application also gave 22 per cent at the first picking and 12 per cent at the end of second picking more of the total yield open than was secured from the adjoining plat which had received no fertilizer treatment.

Basic slag was found to hasten maturity even more than acid phosphate, as was shown by practically one-half of the cotton being open at the first picking on the plat which received an application of this material in connection with normal quantities of manure salt and dried blood (48 pounds of manure salt and 78 pounds of dried blood). On the plat to which phosphoric acid, in connection with normal application of potash and nitrogen, was supplied from acid phosphate, it was found that about 12½ per cent less of total cotton opened at the first picking than did on the plat from which the phosphoric acid in equal quantities was furnished from basic slag under the

[1] Compiled from North Carolina Sta. Rpt. 1909, p. 37.

same conditions. When this latter material was applied in the drill in connection with a ton of stable manure per acre, the effects upon hastening maturity were markedly reduced.

Where high-grade, finely ground phosphate rock as a carrier of phosphoric acid was used at the rate of 274 pounds per acre (four times normal phosphoric acid) in connection with a ton of stable manure, and both were applied in the drill, it was noted that the percentage of total seed cotton open at the first picking was about 35 per cent and at the end of the second more than 20 per cent greater than on an unfertilized plat adjacent.

THE SCUPPERNONG AS A PROFITABLE CROP.[1]

In recent years the growing of scuppernongs for wine making has developed into a local industry of considerable importance. In a recent report of the North Carolina Experiment Station, W. C. Etheridge describes methods of growing and keeping the grapes and the processes of wine making locally used.

A large part of North Carolina, particularly the eastern sound-bordering counties, offers an opportunity to the farmers located therein for the development of a substantial industry which may be carried on to advantage along with the usual farm operations of the locality, or taken singly and more extensively.

This is the growing for commercial purposes of scuppernong grapes, to which the section is ideally adapted in soil and climate. With such natural advantages there is wonder that this industry remains undeveloped when the only other factor wanting is a market, the lack of which may be attributed more to an absence of enterprise in seeking than to its nonexistence, for undoubtedly with some effort and advertising a market could be found for the delicious light wine that may be produced from the scuppernong grape. There are, to be sure, a few large vineyards in the State operated on a commercial basis by several wine companies of another State; but with the small farmer, to whom the scuppernong might be made to yield as reliable revenue as his staple crops, the industry is dormant.

The vines are always propagated from runners which may be had from any established vine by pulling or digging up the overhanging and rooted branches. These should be set out in the fall, and may be trained either on a scaffold or trellis, the former requiring less attention, while the latter affords easier access for pruning and gathering the fruit and gives the vine more fruit-bearing surface. If a scaffolding is used, the main posts should be of fat pine, if obtainable, as these will last indefinitely, although cypress and juniper make very good ones if the part that is to be buried is given a coating of tar. The running poles are best if of large cypress, or juniper saplings, 3 to 5 inches in diameter, stripped of their bark; yet any sort of pole or rail may be used for this purpose, as it may easily be replaced when rotten. If trellising is preferred, convenience may again be regarded in the selection of posts, as on account of their small size it is not difficult to replace them when needed.

Although a trellised vine would require more attentive pruning, the work of the South Carolina Station, as reported in a previous bulletin of this series,[2] indicates that whether grown on arbor or trellis the vines will succeed better if rightly pruned.

For making wine only ripe and perfectly sound grapes should be used. When fully ripe they are shaken into large sheets of burlap, or cloth, spread underneath the vine,

[1] Compiled from North Carolina Sta. Rpt. 1909, p. 117. [2] U. S. Dept. Agr., Farmers' Bul. 374, p. 11.

the shaking being easily accomplished by jarring the vine with a pole crotched at one end, by which a hold is obtained on the vine. Such trash from the vine, leaves and broken bits of stems or twigs, as may have fallen into the sheet is carefully picked out and the grapes are ready for the press.

The process is very simple, being only a flat, shallow trough about 8 feet long, 3½ feet wide at one end, tapering down to about 18 inches at the other, and having fixed at about 30 inches from the wider end a wooden roller 6 or 8 inches in diameter. This roller is covered spirally with strips of leather, which give it a better catch on the grapes and make it less liable to smash the seed than if its surface were bare. To either or both ends is fitted a crank for turning. When in use the trough is fixed between four posts at a convenient height for pouring in the grapes and is slightly inclined for the flow of the juice. The grapes are poured into the trough behind the roller, and it is slowly turned over them, crushing out the juice, which is received into a pail or tub placed beneath the lower end of the trough and is then strained into stands usually made by sawing a good oaken barrel through the middle. The juice is afterwards filtered through some material that will catch the smaller rags of pulp and broken bits of seed which have escaped the strainer. A filter commonly used in the eastern part of the State is made of small pieces of sea shells wrapped or mixed with clean, bright broom grass and placed in a large funnel. This is very effective in clearing the juice.

After filtering, the juice is transferred to barrels, where it may be sweetened at once or after fermentation, this depending upon the quality of wine desired. If the sweetening is done before the juice ferments the wine retains much of the mild, natural flavor of the ripe fruit, but does not have the body, or "tang," that results if fermentation is first allowed. The amount of sugar to be used in sweetening is between 2 and 3 pounds per gallon of juice, and varies with the time the wine is to be kept; if it is intended for use within a year or two, less sugar is required than if the wine is to be aged; and less is needed if the sweetening is done before than after fermentation. After the juice is in the barrels the bungs are left out until all the fermentative gases have escaped, and are then driven tightly in.

Converting the fruit into wine is easily the most profitable disposal that can be made of it, provided a market can be found. A bushel of grapes will yield, even with the present crude methods of pressing, 3 gallons of wine, exclusive of the sugar added in sweetening. This should sell for at least $2 per gallon, making a gross return of $6 per bushel for the grapes. The cost of making the wine is small, as the method is a simple and easy one, requiring little skill and no apparatus that may not be provided at home. The only material entering into the process that need call for a direct expenditure is the sugar used in sweetening, and even this is used at a profit, as it increases the volume of the wine in about the same proportion as its own volume, the value of the extra quantity of wine produced exceeding the cost of the sugar.

EARLY SPRING LAMBS IN THE SOUTH.[1]

In a bulletin of the Alabama Experiment Station D. T. Gray and J. W. Ridgway strongly advocate increased attention to animal production in the South, pointing out especially the many natural advantages of that region for sheep raising.

The northern farmer must be contented with a grazing period of 6 months or less and must give early lambs expensive hothouse treatment during the cold winter months, while a large part of the South can have permanent pastures for 10 months in the year by the use of Bermuda grass, bur clover, and Japan clover. Temporary

[1] Compiled from Alabama College Sta. Bul. 148; Missouri Sta. Circ. Inform. 25; Tennessee Sta. Bul. 84.

winter pastures may be resorted to during the remaining 2 months, thus giving the advantage of pasture 12 months in the year.

Sheep raising will insure some return in case the money crop is a total or partial failure. Should the season be too wet for cotton, it will very probably be favorable for the pastures which feed the sheep, and the wool and lambs will furnish a very acceptable source of income. The early lambs will bring returns in the spring, which ordinarily marks a time of low income and considerable expenditure for fertilizer, seed, machinery, and other things necessary for the season's work. Another advantage is that sheep require most attention at the time when southern crops need little or no attention.

There is always a good demand for the early, or spring, lamb. Should the local market not demand all that the farmer can produce, they can be shipped to the larger cities, for prices are often sufficiently high to justify the payment of express charges. The early lamb is usually born in December or early January and ready for market by the middle of April in Alabama, but in Tennessee the season is somewhat later. According to a court ruling, a spring lamb there is one born after January 1. The Tennessee lamb brings the best price between May 25 and June 15, after which the Kentucky lamb becomes a more active competitor, and prices become lower.

A good winter range or canebrake will furnish ample feed for the ewes, which will require no further attention under these conditions, save at lambing time, but the small farmer usually does not have these facilities. This does not prevent the sheep from being especially adapted to the needs of the farmer with little capital. Oats, vetch, rye, wheat, bur clover, and barley pastures may readily be resorted to. The southern ewe, which quite generally prevails south of Nashville, Tenn., and is usually secured as a basis of the flock, may be had at prices ranging from $2.50 to $4.50. When crossed with a Down ram, a medium good lamb for spring market is the result. These ewes will increase from a purchase weight of 80 to 90 pounds to 125 or 130 pounds when the lamb is sold in the spring. However, until the increase in the spring lamb trade exhausted the supply, the Tennessee farmer usually bought when possible the native mountain ewe, bred largely on the Cumberland Plateau or the Highland Rim. This ewe is most common north and east of Nashville, and is a leggy, heavy-boned sheep, in some respects resembling the Leicester.

At the Alabama Experiment Station a flock of scrub and grade ewes, headed by a Southdown ram, was handled under conditions similar to those of the average small farm of that State. During the summer months no attention was given to the sheep on pasture except to see that they had plenty of water and a mixture of 1 part of tobacco dust and 4 parts of salt at all times to keep down stomach

worms. When the worms are troublesome the flock should be changed from pasture to pasture as frequently as possible, except when on a large range, to prevent or check reinfestation by worms.

As the lambs were to be dropped in December or early January, the ewes were "flushed" by turning them on fresh pasture and giving them a little cottonseed meal daily during July and August preceding the breeding season. The ewes were kept neither too fat nor too poor during these months. The station ram was allowed to run with the flock at all times, but had there been as many as 50 ewes he would have been kept away during the day.

Although many southern farmers feed nothing but cottonseed meal and hulls to the ewes, others avoid cottonseed and its products, claiming that they cause blindness, dizziness, and sometimes death. To test this point the old flock was divided into two lots, one of which was fed upon soy-bean hay alone and the other upon cottonseed meal and hulls. No bad results are reported from either feed. Both lots of ewes came to the lambing period in excellent health and spirit, but those fed on cottonseed meal seemed more alert and spirited than the soy-bean lot. Notwithstanding these favorable results in feeding cottonseed meal, some caution is necessary in feeding it. Recent investigations by Dr. Crawford, of the Department of Agriculture, indicate that cottonseed meal contains a salt of pyrophosphoric acid, which may cause serious trouble. Probably some kinds of cottonseed contain this poisonous matter in larger amounts than others, which may account for the fact that some feeders have had trouble and some have not. Unless the seed fed has been tested in some way, only small quantities should be used at first. During four years' work at this station no ill results have come from the use of cottonseed meal as a feed for sheep, save possibly in one case in 1906. The daily feed eaten by each ewe was 0.5 pound of cottonseed meal and 1.3 pounds of cottonseed hulls, costing 30 cents per month per ewe for this lot, and 1.9 pounds per day of soy-bean hay, costing 35 cents per month per ewe. The total gains per ewe for 106 days were 1.8 pounds for the cottonseed lot and 1.6 pounds for those fed on soy-bean hay. The animals averaged about 95 pounds in weight.

The small farm, as usually managed, does not afford green feed throughout the year, so it is necessary to know what increase would be made in the feed given the ewes after lambing. The majority of owners allow animals to run down in flesh at this time, and even the writers on the subject estimate the necessary increase of feed at only 25 per cent. In view of the results of experimental work with grade Angus cows, Prof. Mumford, of the University of Illinois, says:[1] "In this test it took approximately twice as much feed to maintain a cow

[1] Illinois Sta. Bul. 111, p. 338.

suckling a calf as it did during her pregnancy." Accordingly the feed of these ewes was doubled in amount, but as they immediately began to increase in weight the amount was reduced until they were receiving 75 per cent more cottonseed meal and 81 per cent more hulls than when dry. These amounts were found to maintain them without material increase or decrease of weight. The cost per ewe per month on this ration was 54 cents.

If the purposes of the experiment had not compelled the continuance of the animals on the dry feed, the most economical method of management would have been to turn ewes and lambs upon the green pastures. Under the conditions only the lambs were permitted to run on the pasture of fall-planted oats and vetch, which were ready for grazing by the time the lambs could use them. Any animal makes its cheapest gains when young, so it pays to feed the lambs well. They will begin to eat when about 10 days old. Although they will eat but little corn, the 6.6 bushels of coarsely ground corn which 14 lambs ate helped to finish them for market at an earlier date. They were sold at an average age of 101 days and an average live weight, at Atlanta, of 51 pounds. While the station accounts show a profit of only $10.11 on the transaction, it must be remembered that for the purposes of the experiment an uneconomical method of feeding the ewes was followed, and that in addition to bringing this profit they had furnished a market for the feed consumed at the rate of $25 per ton for cottonseed meal, $6 per ton for hulls, $12.50 per ton for soybean hay, and 10 cents per month per sheep for pasture, and that the fertilizing elements of these crops were retained on the farm in a form fully as valuable, weight for weight, as many commercial fertilizers for which high prices are being paid.

The earliest bunch was sent to Atlanta to market April 23. Two of the lambs sold for 9 cents per pound, live weight, 3 for 8½ cents, and the remainder marketed later at 8 cents per pound. The fact that the later ones were of better quality emphasizes the importance of marketing before the weather becomes warm and the demand weakens. The market opens with what is known as the Easter lamb, one which is of good quality and weighs from 40 to 45 pounds. Although the Easter lamb from Tennessee will sell at from 9 to 12 cents, it holds the same position in the sheep market that the Christmas steer does in the beef market, and a few loads will supply the demand. Any surplus is a drag on the market. It does not pay to market a lamb at 40 pounds, since the ewe must be maintained an entire year and the lamb may be made to weigh 80 pounds at practically the same cost required to bring it to 40 pounds.

Experiments at the Missouri Agricultural Experiment Station show that the best gains were made by fattening sheep when corn

formed a part or all of the ration and that a better finish resulted, while a ration of wheat bran exclusively proved inferior for fattening lambs. A feeder from which the animals were able to supply themselves with grain at all times proved too expensive to be recommended. When roots formed a part of the ration better gains were made and less dry matter required to produce a pound of gain. Shearing late in winter increased the weight of gain, but shearing December 1 was not followed by good results. Animals fattened on rape during the fall were as successful feeders as those pastured on grass during the same period.

An Alabama farmer, who started with scrub ewes and tries to keep about 100 ewes in the pasture with 150 cattle, writes the experiment station that "our investment in sheep has never paid us less than 100 per cent and many years has paid us even more than that. The higher we grade them up the better they pay us, notwithstanding the fact that the higher they are graded up the greater price we place upon the breeding flock." The same writer sums up the advantages of sheep raising on the southern farm in these sentences: "They require but a small capital to begin the business. They will do well on hilly and broken lands. Their manure is one of the richest animal manures that can be obtained. The money comes in from them in the spring and early summer when money is scarce. They subsist on things that other animals will not eat. They afford us two sources of profit—wool and lambs."

THE PRODUCTION OF SANITARY MILK.[1]

The great problem in the production of sanitary milk is to exclude bacteria. It is commonly understood that to prevent contamination of the milk the cow stables, milk utensils, and the milker should be kept as clean as possible, and that the stable should be so constructed that it may be easily and thoroughly cleaned. The air of the stable should be as free as possible from dust when milking. Some of these factors which enter into the production of sanitary milk have been discussed in a previous bulletin of this series.[2]

Recently the Virginia Station has determined the number of bacteria and the relative importance of observing these and other precautions taken to avoid contamination. By actual count it was found that sprinkling the straw bedding, so as to prevent dust and bacteria from arising, the percentage of bacteria in the milk was reduced 53 per cent. A reduction of 25 per cent was secured when a closed pail was used in milking as compared with an open pail. About 23 per cent of the bacteria were eliminated when the flanks of the well-cleaned cows were moistened before milking. Discarding

[1] Compiled from Virginia Sta. Bul. 185.

[2] See U. S. Dept. Agr. Farmers' Bul. 273, p. 23.

the first four strippings from each teat was also of some importance in reducing the bacterial count. These four precautions—sprinkling the bedding, moistening the flanks of the cow, using a closed pail, and discarding the first strippings—can be observed without any appreciable expense, and no dairyman can afford to neglect them.

An experiment was also conducted by the same station to test the relative value of straw and sawdust as bedding. The stable was bedded half with straw and half with sawdust. By actual count there was an average of more than twice as many bacteria when straw was used as when sawdust was used. On the other hand, sawdust is of little value as a manure and to some extent detracts from the value of the droppings of the cow, while straw is a good absorbent and has a value of its own as a fertilizer.

When a milking machine is used some precaution for preventing the development of bacteria in the rubber parts must be observed. Soaking these parts in limewater is effective, and when this is done the milk from a milking machine should contain no more bacteria than when the cows are hand milked.

LACTO: A NEW AND HEALTHFUL FROZEN DAIRY PRODUCT.[1]

In a recent bulletin of the Iowa Experiment Station, M. Mortensen and John Gordon describe the preparation of a new frozen product made of loppered whole or skim milk with the addition of eggs, sugar, lemons, and flavoring material, which it is claimed has a more pleasing flavor than sherbets and ices and contains considerably more nutriment. This product, for which the name "lacto" is proposed, is thought to have medicinal as well as nutritive value on account of its acidity, resulting from lactic-acid bacteria. The preparation of the product is described as follows:

PREPARATION OF MILK USED FOR MANUFACTURE OF LACTO.

The milk for lacto is prepared in a similar manner to the starter which is used for cream ripening. A commercial lactic-acid culture is used. This is added to a pint of skimmed milk which has been pasteurized at a temperature of 85° C. (185 F.) for 20 minutes, and after pasteurization cooled to from 20° to 22° C. (68–71 F.). The lactic-acid culture is mixed thoroughly with the milk and left at 20° C. (68 F.) until the milk has coagulated. Then another bottle of skimmed milk is pasteurized and cooled in the same manner, but instead of the commercial culture a part of the coagulated milk is added to insure the souring of the milk inside of 18 hours. This operation is repeated until the final batch of soured milk obtained has lost the undesirable flavor due to the substance in which the commercial culture was preserved. After this point has been reached, which requires from four to six days, the last sample of soured milk obtained is added to a larger amount of pasteurized skimmed milk. This is then treated the same as the former lots. In this way an amount of milk sufficient to work with is obtained.

[1] Compiled from Iowa Sta. Bul. 118.

Where lacto is to be made in the household on a small scale it may prove too expensive to buy commercial lactic cultures. A family recipe then would be as follows:

Take a bottle of good clean fresh milk which has not been heated, set it away at a temperature of from 68° to 70° F. until it coagulates. If it coagulates as a smooth solid curd without pin holes, if the aroma is clean and pleasant, and the flavor nice and creamy, it can be used as a starter for a larger amount of pasteurized whole or skimmed milk.

The milk when ready to be used for lacto has an acidity of 0.7 to 0.8 of 1 per cent expressed in terms of lactic acid. It must be of a mild and clean acid flavor. The curd must be thoroughly broken up. This is accomplished by pouring it from one pail to another until it is as smooth and velvety as rich cream. From this milk, which in this connection we will call "lacto milk," the various lactos are prepared by the following formulas:

FORMULAS FOR LACTO.

Each of the following formulas will make 5 gallons of the finished product:

Cherry lacto—
- 3 gallons lacto milk.
- 9 pounds sugar.
- 12 eggs.
- 1 quart of cherry juice or concentrated chorry sirup.
- 1½ pints lemon juice.

Orange lacto—
- 3 gallons lacto milk.
- 11 pounds sugar.
- 12 eggs.
- 2½ quarts orange juice.
- 1½ pints lemon juice.

Mint lacto—
- 3 gallons lacto milk.
- 9 pounds sugar.
- 12 eggs.
- 1 pint concentrated crème de menthe sirup.
- 2½ pints lemon juice.

Pineapple lacto—
- 3 gallons lacto milk.
- 9 pounds sugar.
- 12 eggs.

Pineapple lacto—Continued.
- ½ gallon grated pineapple.
- 1½ pints lemon juice.

Marachino lacto—
- 3 gallons lacto milk.
- 9 pounds sugar.
- 12 eggs.
- 1 quart marachino cherries grated.
- 1½ pints cherry juice or concentrated cherry sirup.
- 1½ pints lemon juice.

Raspberry lacto—
- 3 gallons lacto milk.
- 9 pounds sugar.
- 12 eggs.
- 1 quart red raspberry juice or concentrated sirup.
- 1½ pints lemon juice.

Grape lacto—
- 3 gallons lacto milk.
- 9 pounds sugar.
- 12 eggs.
- 1 quart grape juice.
- 1½ pints lemon juice.

PREPARING THE MIXTURE.

The sugar is first dissolved in the lacto milk. The eggs are then prepared. The whites and yokes are kept in separate containers and each lot is beaten with an egg beater. Both the yolks and whites are then added to the milk. The mixture is thoroughly stirred and strained through a fine wire gauze. The fruit juices are added last. If there is any indication of the juices precipitating the casein, they should be left out until the mixture has begun to freeze, when they may be added. The freezer is now run until it turns with difficulty, when the paddle is removed. The brine is removed and the freezer repacked with ice and salt and left for an hour before the contents are served.

The authors see no reason why lacto "should not within a reasonable time become just as popular as sherbet." It has the advantage of having in addition to a pleasant taste considerably more nutriment.

A REENFORCED BRICK SILO.[1]

Having had good results with a brick silo constructed in 1904, the West Virginia Station undertook, in 1909, to construct a larger reenforced brick silo which should have all of the advantages of the first brick structure, and yet be much less expensive. The construction of this silo is described by Horace Atwood in a recent bulletin of the West Virginia Station as follows:

An excavation was made about 4 feet deep to the underlying rock in order to secure a solid foundation. Then a cylindrical brick wall was laid up the width of a brick, or 4 inches thick, cement mortar being used. As the wall was laid, 20d. wire nails, which previously had been annealed by heating them, were embedded in the mortar with the ends projecting from the wall about 2 inches into the silo. About two nails were used per square foot of surface.

After the wall had stood a few days for the cement mortar to harden, woven wire fencing was cut into pieces of the proper length to go around the inside of the silo, lapping somewhat, and the projecting ends of the nails were clinched over the wires so as to hold the fencing close to the brick wall * * *.

Only fencing with straight horizontal wires should be used for this purpose, for if the fencing is not drawn close to the wall in all places an unnecessary amount of cement is required for the plastering.

Two thicknesses of wire fencing were put on for about one-half of the depth of the silo and for the remainder only one thickness. Each strip of fencing as put on was lapped about 2 inches over the lower one. The top course of fencing was allowed to project about 4 inches above the top of the wall and this was stapled to the plate, thus fastening the roof securely to the structure.

After the wire was in place the inside of the silo was plastered with cement mortar, thus covering the wire. The mortar consisted of one part of cement and three parts of sand.

Four openings were provided at convenient distances for removing the silage. These openings are each 24 by 30 inches in size. The door frames are of cast iron 1 inch in thickness, with a projection which laps a couple of inches over the brickwork on the inside of the silo. There is also a projection an inch high extending around the frame on the inside and 2 inches from the face of the frame and against which the door presses when in place.

The doors were made, as is customary, of two thicknesses of seven-eighths inch flooring, with roofing paper between, and they are held in place by being bolted to 4 by 4 inch pieces of timber, which extend across the door frames on the outside. The nuts on the bolts which pass through the doors and the pieces of timber are tightened from the outside, and in this way the doors can be drawn snugly against the jamb of the door frames.

This silo has been used only one year, but the silage has kept well and the wall successfully withstood the internal pressure.

It is believed that this method of construction possesses many advantages where a permanent structure is desired. The wire fencing, being protected by the coating

[1] Compiled from West Virginia Sta. Bul. 129.

of cement, has no tendency to rust and the life of the silo should be almost indefinite. In every agricultural community the services of a brick mason can be secured easily, the job of laying up the 4-inch wall is a short one, and the farmer himself can put on the wire and do the plastering.

The following statement shows the amount and cost of materials and the cost of construction for a silo 15 feet in diameter and 30 feet deep.

Materials used and cost of construction for silo 15 feet in diameter and 30 feet deep.

8,600 brick	$59.20
Laying brick	76.39
233½ bushels sand	4.66
9½ barrels cement	19.00
Plastering silo	41.20
3 rolls woven-wire fencing	14.00
½ keg of 20d. wire nails	1.50
Lumber for roof	38.90
3,250 shingles for roof	13.00
Carpenter putting on roof and building doors	15.00
4 cast-iron door frames	18.18
Labor excavating foundation	12.00
Total cost	313.03

If, as pointed out above, all of the work except laying the bricks be done by the farmer himself, the actual cash outlay would be much less than that given above.

[A list giving the titles of all Farmers' Bulletins available for distribution will be sent free upon application to a Member of Congress or the Secretary of Agriculture.]